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Data Collected Through the International Assessment Program Studies

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Module Objectives

Describe the assessment design, assessment structure, and data collected through background questionnaires for

- Progress in International Reading Literacy Study (PIRLS)
- Trends in International Mathematics and Science Study (TIMSS)
- Program for International Student Assessment (PISA)

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PIRLS Assessment Design

- Paper-based: Multiple-choice and constructed-response items
- 10 passages: 5 literary, 5 informational
- Multiple matrix sampling approach
  - Items clustered in blocks
  - Blocks distributed across set number of booklets and PIRLS Reader (short anthology of reading texts)
  - One booklet (or reader) per student
    - The distribution of blocks across booklets links the booklets to enable the achievement data to be scaled using IRT methods
- Scale scores and international benchmarks

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PIRLS Assessment Structure

Testing time per student	1 hr 20 mins
Total number of blocks (info/lit)	10 (5 info/5 lit)
Number of booklets including Reader (blocks each)	13 (2)
Average number of score points in each block	15

PIRLS 2011 Booklets

	1	2	3	4	5	6	7	8	9	10	11	12	R
Part 1	L1	L2	L3	L4	I1	I2	I3	I4	L1	I2	L3	I4	L5
Part 2	L2	L3	L4	I1	I2	I3	I4	L1	I1	L2	I3	L4	I5

Key

L – Literary Experience

I – Acquire and Use Information

R – Reader

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PIRLS Assessment Structure (Continued)

- 1.5 – 2 hours total for PIRLS administration
- Background Questionnaire time: approximately 30 minutes
- PIRLS 2011: 6 of 10 blocks from 2001 and/or 2006 (trends), 4 new blocks

Item Format	Total Items	Achieved Percentage of Score Points	Target Percentage of Score Points
Multiple-choice	74 (74)	42%	50%
Constructed-response (I point)	28 (28)	58%	50%
Constructed-response (2 points)	26 (52)		
Constructed-response (3 points)	7 (21)		
Total	**135 (175)**		
Note: Score points shown in parentheses.			

For more information, see the PIRLS 2011 Framework

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PIRLS Assessment Development

- Reading items
  - About half of all items are newly-developed each round
- New items field tested in most participating education systems to evaluate
  - Difficulty
  - Ability to discriminate between high- and low-performing students
  - Effectiveness of distractors in multiple-choice items
  - Scoring suitability and reliability for constructed-response items
  - Bias toward/against individual countries or gender
  - Grade-appropriate language and content
- See PIRLS released items

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PIRLS Assessment – Aspects of Reading Literacy

Written Test of Reading Comprehension				Background Questionnaire
Purposes of Reading		**Processes of Comprehension**		**Student Reading Behaviors and Engagement**
Literary experience	50%	Focus and retrieve explicitly stated information	20%	Assessed by the student background questionnaire
Acquire and use information	50%	Make straightforward inferences	30%	
		Interpret and integrate ideas and information	30%	
		Examine and evaluate content, language, and textual elements	20%	

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PIRLS Student Questionnaire

- Demographics
- Home experiences, activities, and resources related to reading
- Out-of-school reading
- Self-perceptions and attitudes related to reading
- Reasons for reading
- Perceptions about school and classroom reading instruction

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PIRLS Teacher Questionnaire

- Administered to the reading teacher of the sampled class
- Teachers are asked about
  - Class characteristics
  - Reading levels and language abilities
  - Instructional time/materials/activities
  - Classroom resources
  - Assessment practices
  - Home/school connections
  - Their attitudes and background

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PIRLS School Questionnaire

Administered to the principal/administrator of each sampled school to describe

- Community
- Personnel
- Assignments
- Policy
- Budget
- Curriculum
- Enrollment
- Student behavior issues

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PIRLS Curriculum Questionnaire

- Administered to the PIRLS National Research Coordinator for each education system
- Focuses on the education system's organization and the national/regional curriculum

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TIMSS Assessment Design

- Paper-based: Multiple-choice and constructed-response items
- 28 blocks (item sets)
  - 14 for math and 14 for science
  - 10-14 items in each block at grade 4, and 12-18 at grade 8
  - Secure (trend) items are in separate blocks from new items
- 14 booklets (each with 4 blocks of items distributed across mathematics and science content domains)
  - 1 booklet per student
- Limited student testing time
  - Grade 4 – 70 minutes; Grade 8 – 90 minutes

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TIMSS Booklet Design

Booklet	Part 1	Part 1	Part 2	Part 2
1	M01	M02	S01	S02
2	S02	S03	M02	M03
3	M03	M04	S03	S04
4	S04	S05	M04	M05
5	M05	M06	S05	S06
6	S06	S07	M06	M07
7	M07	M08	S07	S08
8	S08	S09	M08	M09
9	M09	M10	S09	S10
10	S10	S11	M10	M11
11	M11	M12	S11	S12
12	S12	S13	M12	M13
13	M13	M14	S13	S14
14	S14	S01	M14	M01

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TIMSS Assessment Structure

- Total number of items
  - 347 at grade 4 (175 mathematics items and 172 science items)
  - 434 at grade 8 (217 mathematics items and 217 science items)
- About half of score points from multiple-choice items and half from constructed-response items
- Calculators permitted during the 8th-grade assessment, but not allowed at 4th grade
- Scale scores and international benchmarks

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TIMSS: More information

- TIMSS 2011 Assessment Frameworks
- Principles of Multiple Matrix Booklet Designs and Parameter Recovery in Large-scale Assessments
- Methods and Procedures in TIMSS and PIRLS 2011

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TIMSS Assessment Development

- About half of all items are newly-developed each round
- New items field tested in most participating education systems to evaluate
    - Difficulty
    - Ability to discriminate between high- and low-performing students
    - Effectiveness of distractors in multiple-choice items
    - Scoring suitability and reliability for constructed-response items
    - Bias toward/against individual countries or gender
    - Grade-appropriate language and content
- See TIMSS released items

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TIMSS Mathematics Content Domains

TIMSS Grade 4 Mathematics Content Domains	Percentage of score points
Number	50
Geometric Shapes and Measures	35
Data Display	15

TIMSS Grade 8 Mathematics Content Domains	Percentage of score points
Number	30
Algebra	30
Geometry	20
Data and Chance	20

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TIMSS Science Content Domains

TIMSS Grade 4 Science Content Domains	Percentage of score points
Life Science	45
Physical Science	35
Earth Science	20

TIMSS Grade 8 Science Content Domains	Percentage of score points
Biology	35
Chemistry	20
Physics	25
Earth Science	20

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TIMSS Cognitive Domains

	Grade 4		Grade 8	
	Mathematics	Science	Mathematics	Science
Knowing	40%	40%	35%	35%
Applying	40%	40%	40%	35%
Reasoning	20%	20%	25%	30%

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TIMSS Student Questionnaire

- Demographics
- Home educational resources
- Beliefs and attitudes about learning mathematics and science
- Self confidence in learning mathematics and science
- Perception of mathematics and science lessons
- School climate
- Homework

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TIMSS Teacher Questionnaire

- Administered to the mathematics and science teachers of sampled students
- Teachers are asked about their
    - Attitudes/beliefs about teaching/learning mathematics and science
    - Assignments/topics
    - Class size/organization
    - Teaching tools
    - Instructional practices
    - Professional preparation/development

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TIMSS School Questionnaire

Administered to the principal/administrator of sampled students to describe

- Community
- Personnel
- Assignments
- Policy and budget responsibilities
- Curriculum
- Enrollment
- Student behavior issues
- Instructional organization

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PISA Assessment Subjects

Assessment year	2000	2003	2006	2009	2012	2015 (entirely computer-based)
Subjects assessed	READING Mathematics Science	Reading MATHEMATICS Science Problem solving	Reading Mathematics SCIENCE	READING Mathematics Science	Reading MATHEMATICS Science Problem solving Financial literacy (optional) CBA in reading & mathematics (optional)	Reading Mathematics SCIENCE Collaborative problem solving Financial literacy (optional)

- For each administration all three subjects/domains assessed but one rotating subject/domain receives focus
- Each subject is a major domain every 9 years

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PISA Assessment Design – Overview

- Historically paper-based (PBA), transitioned to computer-based (CBA)
- Multiple-choice, closed short-answer, and open constructed-response items
- Scale scores and proficiency levels

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PISA Assessment Design

- Multiple matrix sampling approach
  - Items grouped into clusters
  - Clusters distributed across set number of booklets
  - One booklet per student
- For more information on multiple matrix sampling, refer to Principles of Multiple Matrix Booklet Designs and Parameter Recovery in Large-scale Assessments
- For more information on how achievement data are scaled using IRT methods, refer to the PISA Technical Report

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PISA Booklet Design

- Assessment items divided into clusters: 7 mathematics, 3 science, 3 reading, and 2 financial literacy
- Clusters distributed across 17 booklets (4 clusters each)
- Each student receives one booklet (2 hours testing time)
- Ensures representative sample responds to each cluster of items

PISA 2012 Booklets

Booklet	Cluster 1	Cluster 2	Cluster 3	Cluster 4
B1	PM5	PS3	PM6A	PS2
B2	PS3	PR3	PM7A	PR2
B3	PR3	PM6A	PS1	PM3
B4	PM6A	PM7A	PR1	PM4
B5	PM7A	PS1	PM1	PM5
B6	PM1	PM2	PR2	PM6A
B7	PM2	PS2	PM3	PM7A
B8	PS2	PR2	PM4	PS1
B9	PR2	PM3	PM5	PR1
B10	PM3	PM4	PS3	PM1
B11	PM4	PM5	PR3	PM2
B12	PS1	PR1	PM2	PS3
B13	PR1	PM1	PS2	PR3
B71	PF1	PF2	PM5	PR2
B72	PF2	PF1	PR2	PM5
B73	PM5	PR2	PF1	PF2
B74	PR2	PM5	PF2	PF1

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PISA Assessment Structure

- PISA 2000: **141 reading items**, 32 mathematics items, 35 science items
- PISA 2003: **85 mathematics items**, 35 science items, 32 reading items, 19 problem-solving items
- PISA 2006: **140 science items**, 48 mathematics items, 28 reading items
- PISA 2009: **102 reading items**, 36 mathematics items, 52 science items
- PISA 2012: **85 mathematics items**, 53 science items, 44 reading items, 40 financial literacy items, **168 CBA problem-solving items**, 164 CBA mathematics items, and 144 CBA reading items

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PISA Assessment Design – Test Scope & Format

Item types

- 50% multiple-choice items (standard or complex)
- 20% closed- or short-response
- 30% open constructed-response

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2012 Computer-based Assessment (CBA)

- Problem solving
  - Administered in 44 education systems, including the United States
- Mathematics and reading literacy
  - Optional assessment administered in 32 education systems, including the United States
  - A subset of students who took the paper-based assessment was also assessed on computer
- 24 forms, 2 clusters together containing 18-22 items
  - 4 clusters problem solving, 4 clusters mathematics, 2 clusters reading
  - 20 minutes testing time for each cluster

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2012 CBA (Continued)

- Interactive nature of computer-based assessment allowed PISA to assess students in novel contexts that are not possible with a traditional paper-based format
- Scores on paper-based assessment cannot be compared to scores on computer-based assessment
- PISA exclusively computer-based in 2015

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PISA Assessment Development

- New items developed by international experts and PISA Consortium test developers
- Field tested in most participating education systems to evaluate
  - Difficulty
  - Ability to discriminate between high- and low-performing students
  - Effectiveness of distractors in multiple-choice items
  - Scoring suitability and reliability for constructed-response items
  - Bias toward/against individual countries or gender
  - Age-appropriate language and content
- See PISA released items

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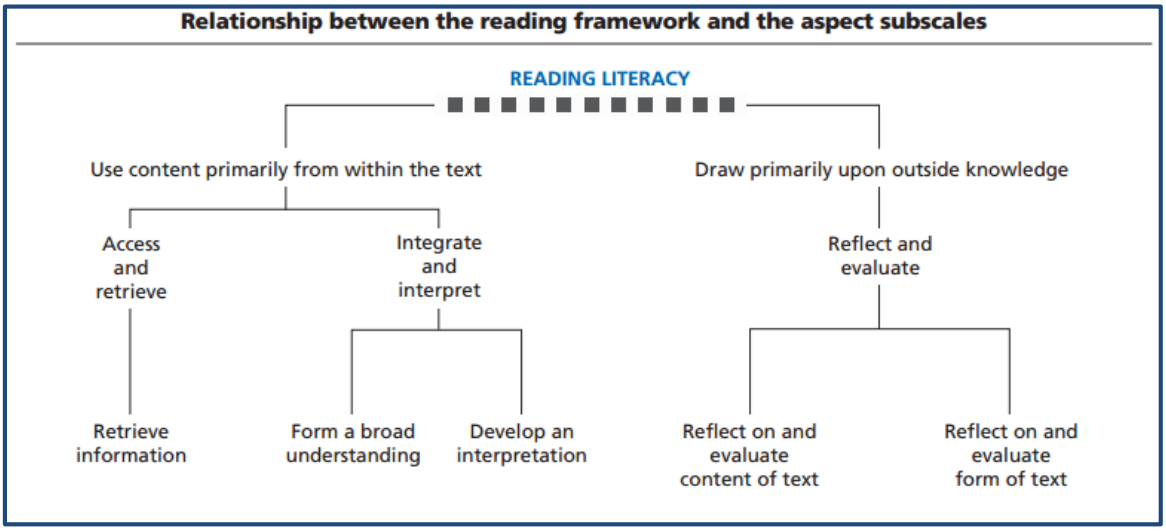
PISA Reading Aspects



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PISA Reading Aspects and Text Format

PISA reading aspects	Percentage of score points
Access and retrieve	22
Integrate and interpret	56
Reflect and evaluate	22

Text format

- Continuous texts – prose (narration, exposition, argumentation)
- Non-continuous texts – lists, forms, diagrams, advertisements

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PISA Reading: Situation and Context

- Personal
  - Tasks to satisfy individual's practical and intellectual personal interests
- Public
  - Use of official documents and announcements about public events
- Occupational
  - Use of text to accomplish immediate task (e.g., manual, report)
- Educational
  - Use of text to acquire information to learn (e.g., textbook, worksheet)

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PISA Mathematics Content (Knowledge) Categories

- Quantity (numerical pattern recognition, counts and measures, relative size)
- Change and relationships (symbolic, algebraic, graphical, tabular, geometric)
- Space and shape (shape/pattern recognition, 3D objects, perspective)
- Uncertainty and data (data/statistics and chance/probability)

Note: The mathematics literacy assessment is about evenly distributed among the four mathematics content categories

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PISA Mathematical Processes

- Formulating situations mathematically
- Employing mathematical concepts, facts, procedures, and reasoning
- Interpreting, applying, and evaluating mathematical outcomes

PISA mathematical process	Percentage of score points
Formulating	25
Employing	50
Interpreting	25

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PISA Mathematics: Situation and Context

- Personal
  - Focuses on activities of one's self, family, or peer group (e.g., personal health and travel)
- Occupational
  - Centered on the world of work (e.g., payroll/accounting and scheduling/inventory)
- Societal
  - Focuses on one's community, whether local, national or global (e.g., demographics and public transport)
- Scientific
  - Relates to the application of mathematics to the natural world and issues and topics related to science and technology (e.g., ecology and medicine)

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PISA Science Competencies

- Identify scientific issues (recognize questions/features of scientific investigation)
- Explain scientific phenomena (e.g., describe phenomena, predict changes)
- Use scientific evidence (interpretations, arguments, conclusions, implications)

PISA science competencies	Percentage of score points
Identifying scientific issues	23
Explaining phenomena scientifically	41
Using scientific evidence	37

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PISA Scientific Knowledge

Scientific Knowledge			
Knowledge OF science	**Percentage of score points**	**Knowledge ABOUT science**	**Percentage of score points**
Physical systems	13	Scientific inquiry (means of obtaining data)	23
Living systems	16	Scientific explanations (results of inquiry)	27
Earth and space systems	12		
Technology systems	9		
Subtotal	50	Subtotal	50

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PISA Science: Situation and Context

- Situation
  - Personal (self, family, peer groups)
  - Social (community)
  - Global (life across the world)
- Contexts: health, natural resources, environment, hazards, science/technology frontiers
- For more information, see the PISA 2012 Framework

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PISA Student Questionnaire

- Demographics
- Socio-economic background
- Attitudes
- Immigration status
- Cultural possessions
- Learning resources in home (e.g., books, room to study)
- Learning time in and out of school
- Study strategies and activities
- Perceptions of teaching and learning
- Perceptions of disciplinary environment

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PISA School Questionnaire

Administered to the principal/administrator of sampled students to describe

- School structure and organization
- Student and teacher body
- School resources
- Instruction, curriculum, and assessment
- School climate
- Policies and practices
- Principal/administrator characteristics

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PISA Teacher Questionnaire

- Administered starting in 2015
- Randomly select up to 25 teachers per school eligible to teach gr. 10
- Teachers are asked about
  - Teacher background information
  - Initial education and professional development
  - Collaboration with parents and teachers
  - Their beliefs and attitudes
  - Teaching practices
  - Availability of school resources

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Module Summary and Resources

Described the assessment design, assessment structure, and data collected through background questionnaires for

- Progress in International Reading Literacy Study (PIRLS)
- Trends in International Mathematics and Science Study (TIMSS)
- Program for International Student Assessment (PISA)

Resources

- Methods and Procedures in TIMSS and PIRLS 2011
- PISA Technical Report
- Principles of Multiple Matrix Booklet Designs and Parameter Recovery in Large-scale Assessments
- PIRLS Framework: 2011, 2016
- TIMSS Framework: 2011, 2015
- PISA Framework: 2009, 2012, 2015
- Released Items: PIRLS, TIMSS, PISA
- Questionnaires: PIRLS, TIMSS, PISA